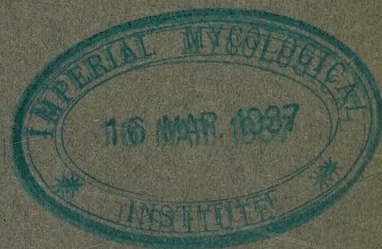


British West Indies Central Sugar Cane Breeding Station.



THIRD ANNUAL REPORT ENDING SEPTEMBER 30TH, 1936.

British West Indies Central Sugar Cane Breeding Station.

THIRD ANNUAL REPORT ENDING SEPTEMBER 30TH, 1936.

BRITISH WEST INDIES SUGAR CANE BREEDING STATION.

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A.I.C., Dip. Agric., (Cantab),
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Members SIR GEOFFREY EVANS, Kt., M.A., C.I.E.,
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HON. A. C. BARNES, C.M.G., B.Sc.,
F.I.C., A.M.I.Ch.E., Director of
Agriculture, Jamaica.

G. A. JONES, Dip. Agric., (Bangor),
Commissioner of Agriculture of the
Agricultural Advisory Department
of the Imperial College of Tropical
Agriculture.

Geneticist A. E. S. McINTOSH, B.Sc., Ph.D.
(Edin.).

Assistant Botanist G. C. STEVENSON, B.A., A.I.C.T.A.

Field Assistant J. N. W. NICCOLLS.

Statistical Clerk A. D. HERBERT, D.I.C.T.A.

ANNUAL REPORT SUGAR CANE BREEDING STATION
1936-37

REPORT FOR THE YEAR 1936-37

By
J. H. HARRIS
Director

U. S. DEPARTMENT OF AGRICULTURE

WASHINGTON, D. C.

1937

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FOREWORD

This, the third annual, report marks the last period for which the Colonial Development Fund is responsible for the annual grant of £2,000, which was deemed necessary in 1932 for the extension of the British West Indies Central Sugar Cane Breeding Station so that it might provide more fully for the British West Indian Colonies other than Barbados, and it is desired to express the greatest appreciation for these annual grants, which have increased the scope and, it is hoped, the value of the work of the breeding station very considerably.

For the next year the Colonial Development Fund and the contributing Colonies share the burden of the £2,000 between them and after that the extra cost, apart from over £5,000 annually provided by Barbados, must be met entirely by the contributing Colonies.

It is gratifying to state that the Station has functioned smoothly during the period under review and that the cumulative effect of the improvements in technique and in the planning of operations is now resulting in the regular production of seedlings which have reached the commercial stage in Barbados, and some of which should prove of value in the noble cane areas in the other British West Indian Colonies.

The breeding of sugar cane seedlings for specific conditions, such as the mosaic infected areas in Jamaica, has naturally not yet reached the stage where commercial varieties are being produced with annual regularity, but it is sufficiently advanced for seedlings of good performance and of parentages which promise resistance to mosaic disease to be sent each year to the Central Quarantine Station in Trinidad for subsequent issue to the interested colonies for further trial.

Advisory Committee.

The fifth meeting of the Advisory Committee was held in Barbados during April. The value of these meetings cannot be over-estimated, and the exceedingly frank discussion on all the problems affecting the Station which formed the subject of the Committee's deliberations proved eminently satisfactory.

Visits of Inspection by the Geneticist.

Owing to the absence of both the Geneticist and the Assistant Botanist on vacation leave (at different times) in the United Kingdom it is regretted that it has not been found possible for either of these officers to make visits to the different contributing colonies.

These visits are of inestimable value to the officers of the Sugar Cane Breeding Station both in discussing the problems of the different colonies and more especially in ascertaining the behaviour of the different sugar cane varieties under the various conditions in which they are being tested.

Personnel.

During the year Mr. J. M. Cave, Field Assistant, left the service of the Station on promotion as Assistant Agricultural Officer in St. Kitts. Mr. Cave was the first officer appointed to the Station after its inception and it is desired to place on record the value of Mr. Cave's services towards the work of the Station.

Mr. Cave's office of Field Assistant was filled by the appointment of Mr. J. N. W. Niccolls on May 1st, 1936.

R. W. R. MILLER,

Director of Agriculture, Barbados.
Chairman, Advisory Committee.

British West Indies Central Sugar Cane Breeding Station.

Report for the Year ending September 30th, 1936.

I. SUGAR CANE BREEDING, SEEDLING SELECTION AND TRIALS.

(i) Sugar Cane Breeding—B.38' Series.

Sugar cane breeding was carried out at Lion Castle estate during October, November and December, 1935. The hybridisation technique was the same as that employed in recent years, and has been fully described in a separate publication (7).

Examinations of the floral characteristics, for sex determination, were made on sixty-one varieties which had not previously been used in breeding. Of these, the following are of the most general interest:

Variety	Sex
B.3013	♂
B.3124	♂
B.693	Strong ♂
B.268	Strong ♂
Badla	Strong ♂

In the above list, the first two varieties are male-sterile Barbados noble canes, which are rarely met with. Their value as seedling producers is awaited with interest, for previously Ba.11569 was the only proven Barbados noble female parent in use. The last three varieties listed had been in the breeding plots for several seasons, but had not arrowed.

In all eighty-five distinct crosses were made. These may be summarised thus:—

(a) Crosses between noble varieties (<i>Saccharum officinarum</i>)	19
(b) Nobilisation of <i>Saccharum barberi</i> .	
(1) first nobilisation	4
(2) second nobilisation	1
(3) third nobilisation	3
(c) Nobilisation of <i>Saccharum spontaneum</i> .	
A. North Celebes form.	
(1) third nobilisation	2
B. Java form.	
(1) second nobilisation	2
(2) third nobilisation	6
(3) fourth nobilisation	20
(4) fifth nobilisation	13
C. Indian form.	
(1) first nobilisation	1
(d) Nobilisation of <i>Saccharum sinense</i> .	
(1) first nobilisation	2
(e) Crosses involving several species of <i>Saccharum</i>	12
Total	85

(ii) Seedling Raising and Planting out—B.38' Series.

Arrow collecting, fuzz sowing, and subsequent germination counts were done as in previous years.

The soil, before being used in the boxes and pots, was passed through a soil steriliser, as a precautionary measure against possible root-attacking fungi, and also to kill weed seeds. The sterilisation treatment was shown, by comparison with control boxes in which fuzz was sown in unsterilised soil, to delay germination for a few days. Final germination figures were, however, highly satisfactory, and not less than the controls. It is intended to employ soil sterilisation as a routine measure in the early stages of seedling propagation in future years.

The noble cane crosses again proved to be generally highly fertile. Exceptionally large seedling populations were obtained from the new crosses Ba.11569 x B.693 and Ba.11569 x Badila.

In the *Saccharum barberi* nobilisation series, germinations were very poor. The crosses Hemja x B.H.10(12) and Hathooni x B.H.10(12) again produced no seedlings. Dacca gave no seedlings when crossed with B.3124, and only seven when crossed with Ba.11569. Of these seven, three proved to be peculiar dwarf types which under field conditions grew only a few inches in height. Co.213 again showed very poor fertility in crosses with B.391, P.O.J.2878 and B.3334, in spite of the use in crossing of excellent mother arrows and heavy pollen-shedding male parents.

Poor germinations were also obtained from crosses between Uba and noble canes, and between Uba and P.O.J.2878. Over 16,000 seedlings were potted during January and February, 1936, of which nearly 15,000 were planted in the field nursery during the following April and May. Pottings and nursery plantings were allocated as follows:—

Nature of cross	No. of crosses	No. of seedlings potted	No. of seedlings planted in nursery
A. Proven Crosses	5	3,768	3,205
B. Semi-proven Crosses	12	5,095	4,745
C. Experimental Crosses:			
(i) Chunnee nobilisations	4	289	280
(ii) Tabongo nobilisation ..	1	32	30
(iii) Gtagah 3rd nobilisation	4	324	300
(iv) „ 4th „	13	1,455	1,298
(v) „ 5th „	10	2,140	1,944
(vi) Crosses involving several <i>Saccharum</i> species ..	10	2,066	1,955
D. Early nobilisations	7	1,015	987
Totals	66	16,184	14,744

NOTE. In the above table by “Proven Crosses” is meant crosses between Barbados noble cane varieties which have been shown by experiment to produce seedlings of a high standard.

“Semi-proven Crosses” are those which have not yet been tested, or tested insufficiently, but which are considered distinctly promising as producers of good seedlings. All are crosses between noble varieties. “Experimental Crosses” are those between varieties whose performance as seedling producers is unknown. “Early nobilisations” are those made primarily with the object of producing material for use as parent plants in special nobilisation schemes for British West Indian conditions.

The general policy which is being pursued in breeding and selecting seedlings is shown in the form of a chart (Appendix A).

Approximately 10,000 seedlings will be selected from the nursery in October for planting in the routine first year seedling trial.

On account of the change-over to the new scheme involving a field nursery stage from April to October, there is no B.36' series of seedlings.

(iii) **Planting First Year Seedlings—B.37' Series.**

The field planting from the nursery of the first year seedlings, at the normal cane hole spacing, was carried out during October and November, 1935.

From a total of 12,223 seedlings in the nursery 7,422 were planted in the first year seedling trial, which will be reaped in 1937. These were made up as follows:—

Nature of cross.	No. of crosses.	Number in nursery.	No. planted in first year trial.
Proven crosses	5	6,200	3,898
Semi-proven crosses	7	1,750	1,083
Experimental crosses:			
(i) Noble cane crosses	3	180	114
(ii) Nobilisations			
(a) <i>Saccharum barberi</i>	4	313	233
(b) <i>Saccharum sinense</i>	2	160	44
(c) <i>Saccharum spontaneum</i> (Local Coimbatore form)	1	230	39
(d) <i>Saccharum spontaneum</i> (North Celebes form) ..	3	235	73
(e) <i>Saccharum spontaneum</i> (Java form)	27	2,610	1,648
(f) including blood of several species	4	545	290
Totals	56	12,223	7,422

From the above figures, it is seen that it was possible to eliminate approximately 40% of the seedlings at the field nursery stage. Bearing in mind the special purposes of individual crosses, the features used in eliminating seedlings were (1) cane width (2) heavy arrowing and to a lesser extent (3) number of canes.

In addition, 27 early nobilised seedlings were allocated to Lion Castle from the field nursery for use in breeding work.

It is concluded that the field nursery represents a valuable stage in the seedling selection scheme, for since it is the aim to provide for a first year trial of approximately 10,000 seedlings, it is now possible, allowing for a 40% elimination, to plant in the field nursery about 16,000 seedlings instead of the 12,000 odd planted in 1935.

(iv) The B.35' Series of Seedlings.

These were selected in the first year trials reaped in 1935, from early and late reaped proven crosses, and from experimental crosses. In all, one hundred and fourteen seedlings from noble cane crosses were selected. These were planted in multiplication plots at Codrington during the spring of 1935. By the crop season of 1936, the *early* group selections had made sufficient growth to allow of taking field and sucrose data for each seedling.

During November, 1935, all selections from noble cane crosses were planted in twenty-four cane hole plots at Dodds. These plots serve (a) to provide sufficient planting material for comprehensive trials of those eventually selected, (b) to test their resistance to gumming disease (9) and (c) to allow of elimination of the obviously poorer seedlings.

For the early group, the field and laboratory data obtained at Codrington in 1936, and for both groups the field and gumming disease resistance data obtained at Dodds during 1936, provide information on which to base the selection of seedlings for inclusion in the routine second year trials for the season 1936-38.

Ninety-nine nobilised seedlings were selected from the experimental cross group. They represent various degrees of nobilisation of several species of *Saccharum* by Barbados varieties.

These were planted in multiplication plots at Codrington, and observations made on their growth and appearance during 1935. In November, 1935, the following allocations were made:

- (1) forty-eight seedlings to the second year trial at Codrington Experiment Station. This trial is divided into two sections: (a) thick cane seedlings, a large percentage of which are probably commercially resistant to mosaic disease, and from which selections will be sent for trial in areas where soil conditions are favourable, but where this disease is of major importance, and (b) thin cane seedlings, selections from which will be sent for trial in poor soil areas in the British West Indies served by the Station, and in froghopper areas.

In the first section, B.2935 is the standard variety, in the second, Co.213.

At the 1937 reaping, selections will be sent to the Plant Quarantine Station, and no further tests will be made with them in Barbados.

- (2) thirty-eight seedlings to the breeding plots at Lion Castle, for use as parent varieties.
- (3) all seedlings to gumming disease resistance tests at Dodds. These tests serve to supply information on the inheritance of gumming disease resistance in varieties involving the blood of various *Saccharum* species.

(v) The B.34' Series of Seedlings.

These are seedlings selected at the reaping of the first year seedling trial in 1934.

The *noble cane* selections were planted in November, 1935, in routine second year trials at Dodds (low rainfall station) and Todds (high rainfall station).

The selections from the *nobilised* seedlings—thirty-four in all—were tested during the season 1934–36 in a second year trial at Codrington. Of the eleven seedlings selected at the reaping of the trial, eight are intended for mosaic disease tests and subsequent field trials in Jamaica, and three for tests in poor soil areas. All have been despatched to the Plant Quarantine Station, and will not be tested again in Barbados.

(vi) Second Year Seedling Trials—B.33' Series.

The methods used in conducting these trials have been fully described in a separate publication (10).

Twenty-three seedlings were tested against the appropriate standard varieties in early and late reapings at Dodds (low rainfall station) and Todds (high rainfall station) during the season 1934–36. The trials also included the variety B.3439, which was promoted to the second year trial owing to its exceptionally promising appearance in the multiplication plots at Codrington the previous year.

Three seedlings were selected, on the results of these trials, for inclusion in maturity experiments and select seedling trials. The following short notes are descriptive of each:—

B.3307. Parentage Ba.11569 x B.417. The canes are of average number, and of good length and width. Juice quality was high at the early reaping. Some arrowing took place, but not to an objectionable degree. Rotting of canes was not marked at either station. This seedling will be tested as an early reaping variety for low to intermediate rainfall districts.

B.3327. Parentage Ba.11569 x B.H.10 (12). The canes are of average number, and of more than average length and thickness. Arrowing was slight. Tonnage was poor at Dodds, but excellent at Todds. This seedling will be included in trials in the medium to high rainfall areas, for early and late reaping.

B.3439. This is a seedling of Ba.11569 and the Queensland variety, Q.813. It will be further tested as a late reaping variety for intermediate to high rainfall areas. It gave good weights, and the juice quality was satisfactory, but the canes, while of more than average number, were somewhat thin, and arrowing was rather marked.

In addition, a *nobilised* seedling, B.3337, was selected as a result of its performance in these trials. This is a seedling resulting from the selfing of

B(30)L7, which in turn was a seedling from the cross P.O.J.2364 x B.391. This seedling will be despatched to the Plant Quarantine Station for subsequent trial in poor soil areas against Uba and Co.213. Its canes are thicker than either of these varieties, and it trashes reasonably well.

(vii) **Select Seedling and Variety Trials. B.32', B.31' and B.30' Series.**

Select Seedling Trials are designed to test promising seedlings, for early and late reaping, over a range of conditions, against appropriate standard varieties.

Variety Trials represent the final stage in seedling testing prior to the recommendation of seedlings for commercial planting. They are large scale trials designed to compare seedling and standard variety in tonnage only. Seedlings promoted to these trials have already shown promise of becoming commercial varieties for particular conditions.

The methods of conducting these two types of trial have been fully described (10). They may be conveniently considered here under one heading.

In the Select Seedling Trials, the following seedlings were tested as *plant canes*: B.3216, B.3234, B.3239, B.3124, B.3125, B.3127, B.3138 and B.3179. The first three were second year selections of the previous season, and the remainder seedlings of an earlier series, included for further trial.

As *first ratoons* the following seedlings were reaped in Select Seedling Trials: B.3013, B.3124, B.3125, B.3127, B.3138 and B.3179.

In a *second ratoon* Select Seedling Trial, B.3013 was reaped.

In the Variety Trials, the seedlings B.3013 and B.3234 were tested in valley soils and higher-rainfall red soil areas. The standard varieties for comparison were, therefore, chiefly B.726 and B.H.10(12).

On account of the marked differential response of sugar cane seedlings to different environments, it is thought advisable, in considering the results of these trials, to group the stations into distinct ecological units. These are as follows:—

Category A. Black, and sandy coral limestone soils, low rainfall. Ratooning difficult, and tonnages generally low.

Stations: (a) Select Seedling Trials, plant canes—Six Mens, Spring Hall, Seawell.

(b) Variety Trials, plant canes—Pollards, Molyneux.

Category B. Black coral limestone soils, ranging from low to intermediate rainfall. A certain amount of ratooning is practised, which would increase were strong ratooning seedlings available.

Stations: (a) Select Seedling Trials, plant canes—Lower Greys, first ratoons—Frere Pilgrim.

(b) Variety Trials, plant canes—Lower Estate.

Category C. Deep black valley coral limestone soils, ranging from low to intermediate rainfall. Waterlogging is sometimes experienced. A considerable percentage of the area is ratooned.

Stations: (a) Select Seedling Trials, plant canes—Carrington, first ratoons—Buttals.

(b) Variety Trials, plant canes—Constant.

Category D. Red coral limestone soils, intermediate—high rainfall. From one to three ratoon crops are grown here. Numerous stations occur in this category on account of (1) ratooning and (2) the testing of the seedlings B.3013 and B.3234 in Variety Trials chiefly in this area.

Stations: (a) Select Seedling Trials, plant canes—Lammings, Apes Hill, Fisherpond. First ratoons—Guinea, Cottage, Wakefield. Second ratoons—Bowmanston.

(b) Variety Trials, plant canes—Applewhaites, Ashbury, Nicholas, Vacluse, Lancaster, Kendal, Clifton Hall, Farmers, Mount Wilton.

Observations on Rainfall During the Season 1934-1936.

The average rainfall for 1935, recorded at a number of stations over the island, was appreciably in excess of that of the forty-year period 1890—1929. Rainfall was particularly high in January, May and July. As a result, the crop tended to be very forward in growth. From mid-December, 1935, to March 1936, i.e. just prior to, and during the greater part of the crop season, a severe drought took place. The effect of this in conjunction with the forward condition of the stools, was to cause an appreciable amount of drying out of canes, and susceptibility of injured canes to damage by weakly parasitic fungi.

These facts have to be borne in mind in interpreting the result of the trials. It will be evident that seedlings resistant to drying out were comparatively favoured, and that, on account of the comparatively long favourable growing season throughout, longer season types were placed at an advantage in all categories.

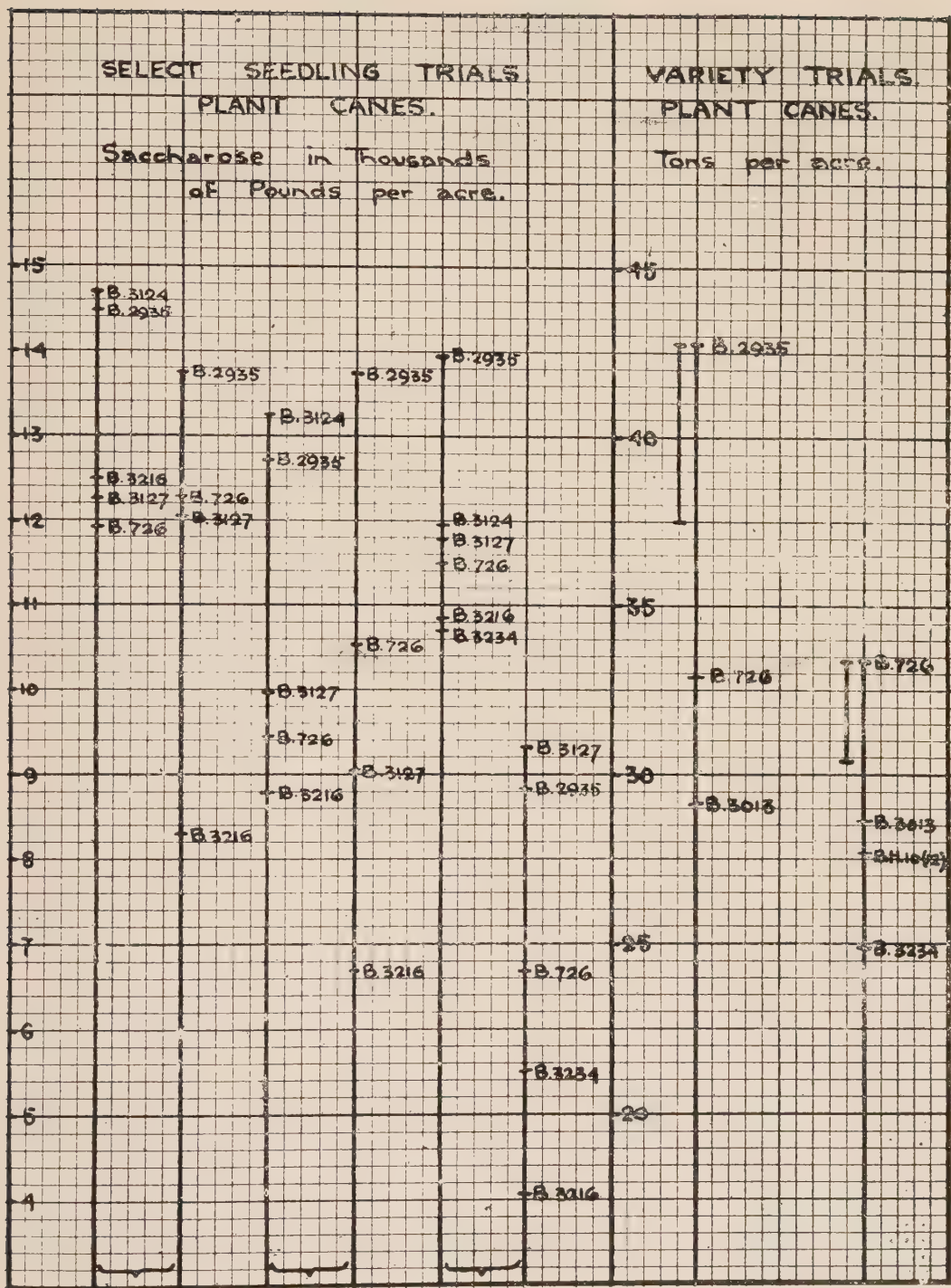
Results of the Trials.

The results of the trials are presented in Figs. I—VI. For the plant cane Select Seedling Trials, yields of saccharose per acre are shown, and for the ratoon Select Seedling Trials and Variety Trials, yields in tonnage of canes per acre. Statistically established significant differences in tonnage between seedlings in the ratoon Select Seedling Trials and Variety Trials are indicated on the diagrams by short lines alongside the appropriate columns representing the yields.

Comments on the Results of the Trials.

Category A.

The standard varieties here were B.726 and B.2935, and the seedlings tested, B.3013, B.3124, B.3127, B.3216 and B.3234.



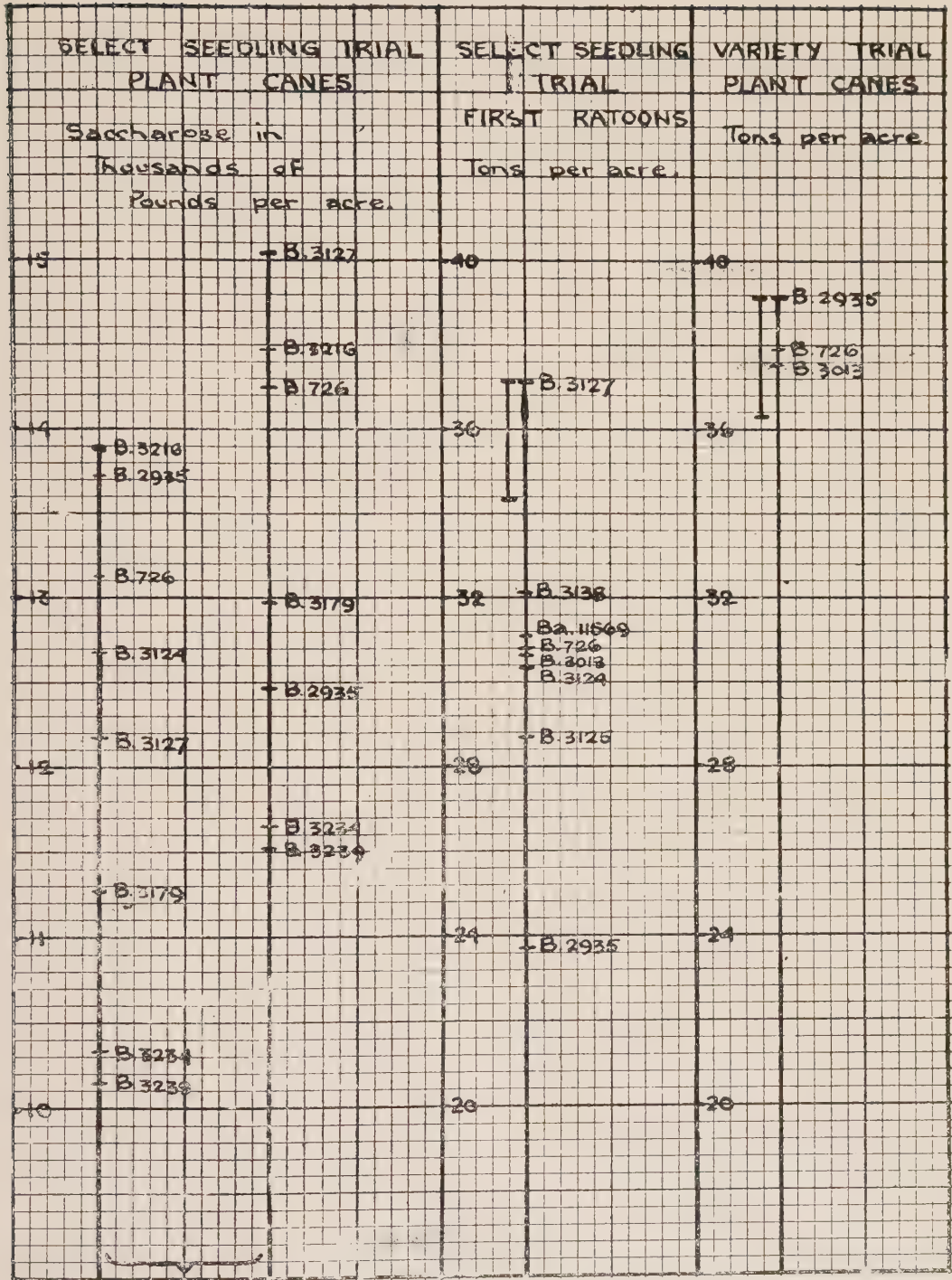
SIX MENS. SPRING HALL. SEAWELL.

30.1.36 16.3.36 5.2.36 24.3.36 6.2.36 25.3.36

POLLARDS. MOLYNEUX.

11.2.36 9.3.36

FIG II. CATEGORY B.

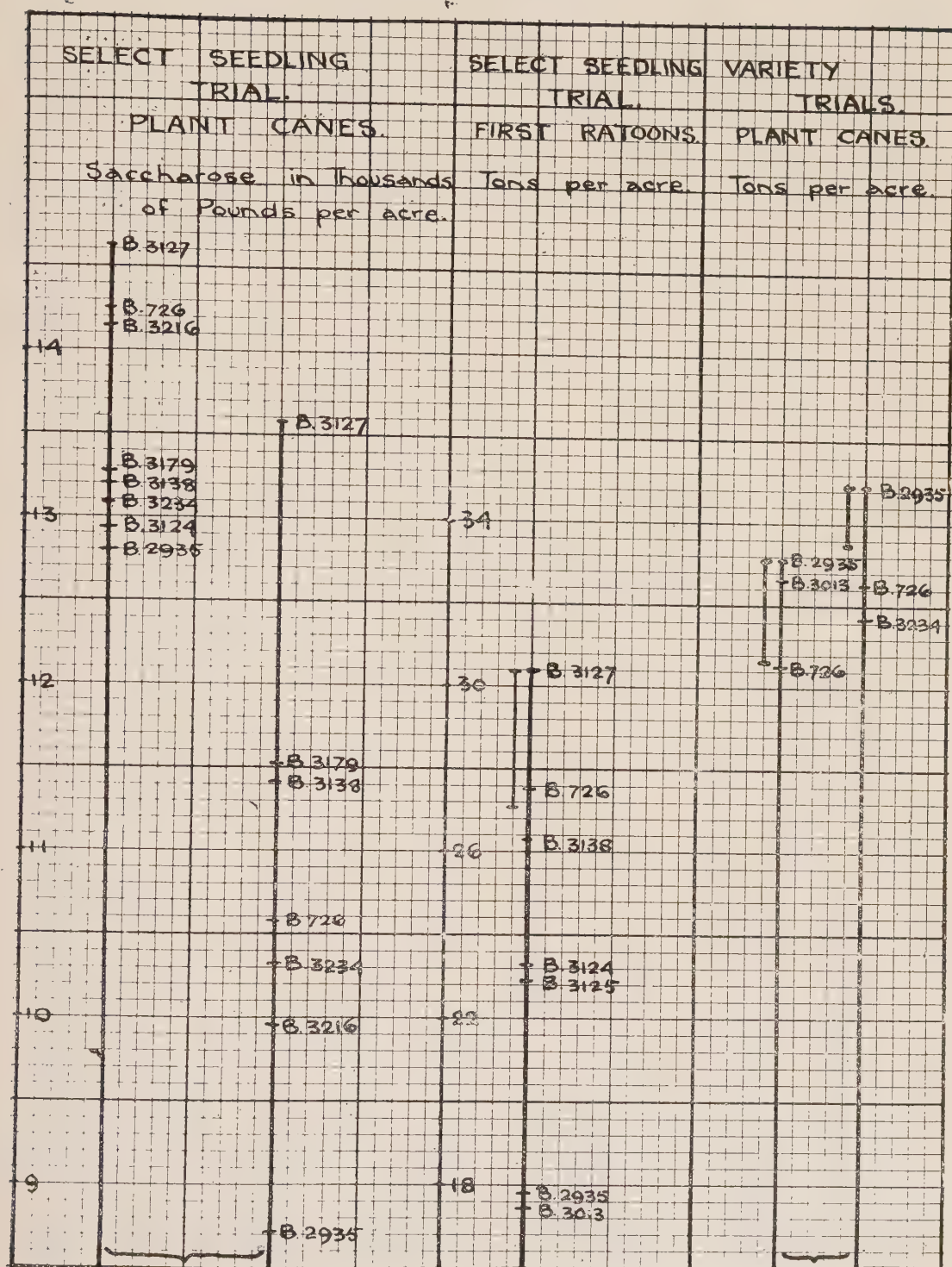


LOWER	GREYS.
13.2.36	26.3.36

FRERE PILGRIM.
12.2.36

LOWER ESTATE
19 2 36

FIG III. CATEGORY C.



CARRINGTON.

BUTTALS.

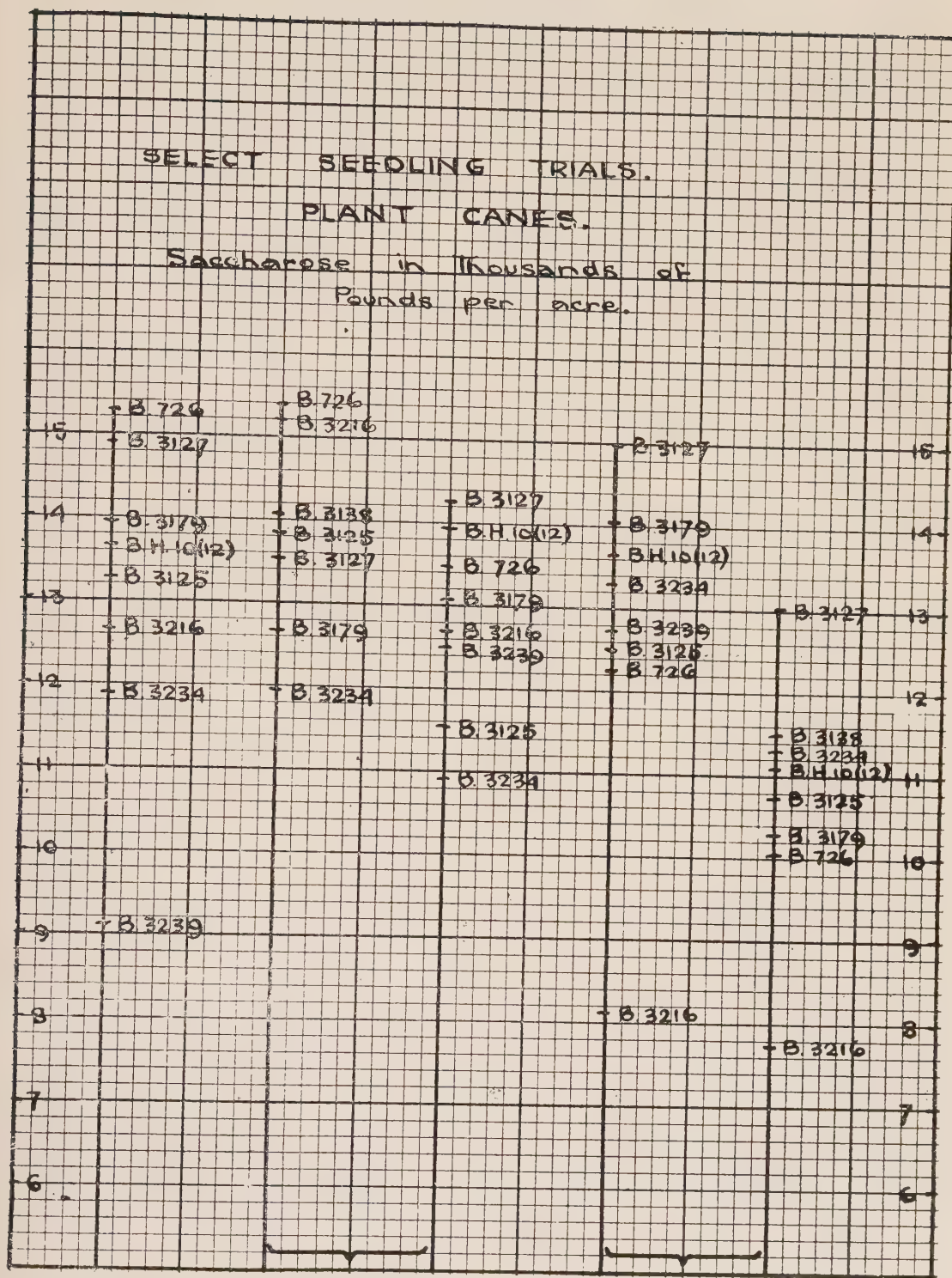
CONSTANT.

14.2.36 27.3.36

10.3.36

4.3.36 19.3.36

FIG IV. CATEGORY D.



LAMMINGS

APES HILL

FISHER POND

21.2.36

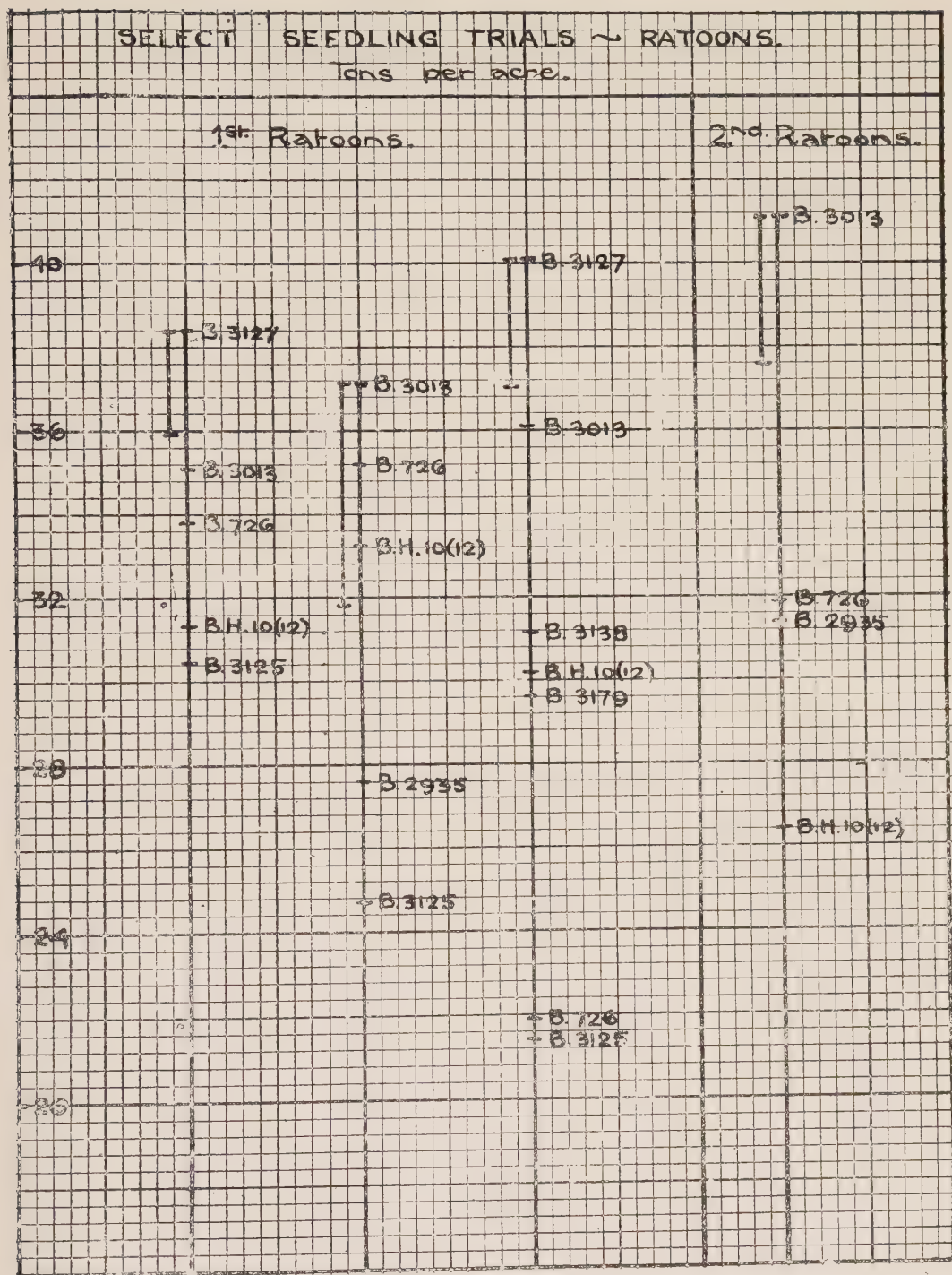
25.2.36

31.3.36

26.2.36

1.4.36

FIG V. CATEGORY D (Cont.)



COTTAGE.

7.4.36

GUINEA.

3.4.36

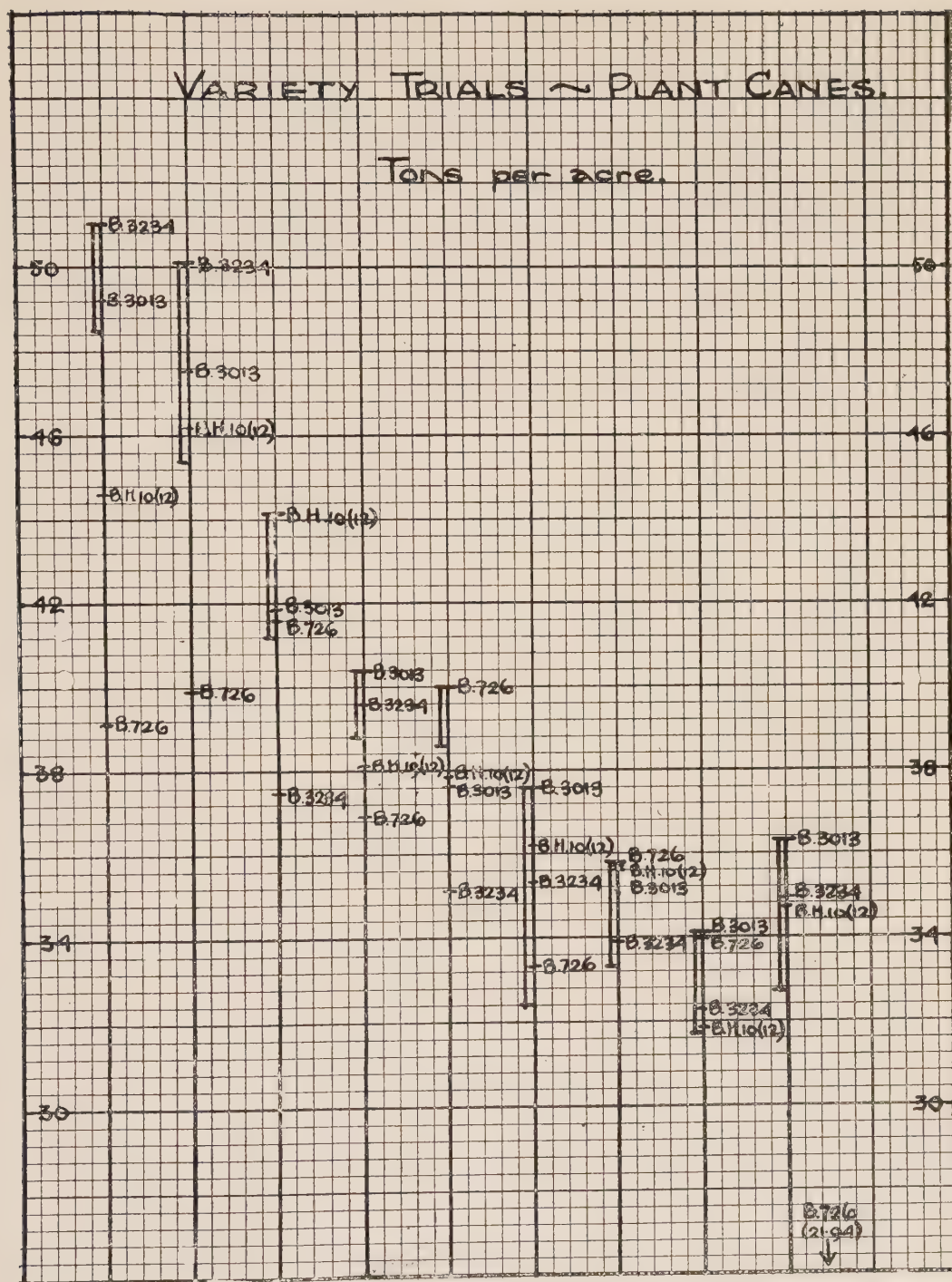
WAKEFIELD.

15.4.36.

BOWMANSTON

17.4.36

FIG VI. CATEGORY D (Concl.)



Kendal.
25.3.36

Lancaster.
23.3.36

Applewhaites.
18.3.36

Vacluse.
15.4.36

Farmers.
21.4.36

Clifton Hall.
31.3.36

Mt. Wilton.
1.4.36

Nicholas.
25.2.36

Ashbury.
17.3.36

B.2935 was emphatically superior to B.726 in cane tonnage and saccharose yield. B.3013 was inferior to B.726. B.3124 shows promise as an early reaping variety for these areas, and has accordingly been allocated to six Variety Trials for early reaping at stations in this category. B.3127 gave yields approximately similar to B.726, and would not appear to be promising for this category except it should prove to ratoon very well (see later). In such an event it might be valuable in giving a ratoon crop where other varieties fail. B.3216 and B.3234 gave inferior performances at these stations.

Category B.

Rainfall conditions tended to favour intermediate-season types, such as B.726 and B.3013, at the expense of shorter season types, as exemplified by B.2935 and B.3124.

The yield of B.3013 was approximately equal to that of B.726, and the chemical analyses of the canes of the two varieties were also similar. Consequently, and in view of the fact that B.3013 has been shown to withstand drought during the crop season better than B.726, it might prove of some value in these areas for late reaping.

The outstanding seedling here was B.3127. In plant canes it showed the highly desirable feature of maintaining its soundness well throughout the crop season, and its ratoon yields were particularly good. Chemical analysis showed that it approximates to B.726, but is somewhat later in maturing. A strong ratooning variety would be very valuable in this area, and B.3127 shows high promise in this respect. It is to be tested comprehensively in Variety Trials in the season 1936—38.

Although B.3216 performed well here, it will be eliminated owing to its high susceptibility to *Rind Fungus* attack.

The other seedlings tested would appear to be inferior to the standard varieties in this category.

Category C.

In the valley soils, the seedling requirements are distinct from those of the contiguous shallow black soil areas.

B.2935 was inferior to B.726, the standard variety in the valley soils, and is not recommended as a commercial variety here.

B.3013 outyielded B.726 as plant canes in the Variety Trial, but in the first ratoon Select Seedling Trial was inferior to B.726. This latter result is peculiar in view of the satisfactory ratooning ability of B.3013 in other trials (See Category D). Further trials are necessary to test B.3013, particularly as a ratooner, in valley soils.

Here again B.3127 was the outstanding seedling, being superior to all other varieties at each reaping. In view of the strong ratooning ability of this seedling, there is high promise of its becoming the standard commercial variety for this area. It has been allocated to Variety Trials with B.3013 and B.726 in 1936—38.

Category D.

For reasons given in a previous section, extensive trials were carried out here.

In the red soils, the crop season drought was felt particularly severely. As a result, intermediate length of season types, like B.726, tended to lose weight by drying out of canes as the crop progressed. Even B.H.10(12), a longer season type, lost considerable weight by the end of the crop. Of these two standard varieties, B.726 outyielded B.H.10(12) early in crop, while in later reapings the position was reversed.

The following seedlings showed no promise of displacing the standard varieties in this category:—B.3125, B.3138, B.3179, B.3216, B.3239.

B.3234 performed well where growing conditions—as judged by tonnages—were very good, but here B.3013 approximated to it in tonnage, and had better cane chemical analyses, so that it is doubtful whether B.3234 will find a place in commercial plantings in Barbados. Trials may prove it to have some value, however, in certain other islands of the British West Indies where growing conditions are good.

The notable seedlings in these trials were B.3013 and B.3127.

B.3013 outyielded the standard varieties in six out of nine Variety Trials as plant canes, and approximated to their yield at the other three stations. As ratoons, it was superior to the standards in all trials.

B.3013 ripens slightly later than B.726, and maintains its soundness well during crop. It shows every indication of becoming a standard commercial variety for mid-crop reaping in this category. At higher fertility levels—as judged by tonnages—B.3013 tends to draw away from the standards, and it ratoons particularly well.

Small-scale commercial plantings of B.3013 will be recommended this year for this district, and more definite allocations should be possible next year when the results of the 1935—37 trials are to hand.

B.3127 gave good performances as plant canes, particularly at later reapings. As ratoons it was outstanding, being well ahead of all other varieties in both trials.

B.3127 is a free-stooling and rapid-growing seedling, with very long canes. It has a tendency to root at the nodes, making reaping somewhat difficult. It is possible, however, that this undesirable habit may be less marked in future years. B.3127 ripens after B.726, but before B.H.10(12), and at its best has a juice quality close to that of B.726.

B.3127 gives promise of becoming a general purpose variety in Barbados, showing possibilities for Categories B, C, and D. It is being extensively tested in future.

II. DESPATCH OF SUGAR CANE SEEDLINGS TO THE BRITISH WEST INDIES CENTRAL PLANT QUARANTINE STATION, TRINIDAD.

During the year, cuttings of the following seedlings were sent for quarantine to the Central Plant Quarantine Station, Trinidad:—B.34104, B.34117, B.34163, B.3172, B.34134, B.34129, B.34130, B.34110, B.34137, B.34106, B.34120, B.34105.

The seedlings B.34104 and B.34163 are from the cross Co.281 x B.H.10(12), and B.34117 is a seedling of P.O.J.2725 x Co.281. All three are intended for trial in poor soil areas in the British West Indies where noble canes cannot be profitably grown. They will be tested against Uba and Co.213.

The remaining nine seedlings in the above list are all of the fourth nobilisation in the glagah blood line, resulting from repeated back-crossing to Barbados noble cane varieties. On release from the Quarantine Station they will be sent to Jamaica for mosaic disease resistance tests and subsequent trial in good soil areas where mosaic disease is of major importance.

Before despatch to the Quarantine Station consignments of cuttings were surface-sterilised with a formaldehyde solution. For sterilization of future consignments, a more convenient hot water treatment is being considered. This treatment involves soaking the cuttings for thirty minutes in water at a temperature of 52°C. Experiments carried out in Barbados with mature cuttings have shown that the treatment does not have a detrimental effect on germination. With cuttings taken at an earlier stage in the growing season, however, it appears that the treatment results in an appreciable reduction in germinating power.

With regard to the seedlings previously sent to the Quarantine Station, and already released from there, later trials in Barbados have shown that the following should be eliminated: B.2931, B.2977, B.3011, B.3179, B.3216, and B.3239. The authorities in the islands to which planting material of these varieties was sent by the Quarantine Station, were notified accordingly.

III. DESPATCH OF SUGAR CANE FUZZ TO TRINIDAD FOR TESTING SEEDLINGS FOR FROGHOPPER RESISTANCE.

Consignments of fuzz from eleven crosses were sent to Trinidad in January. The crosses are detailed in the accompanying table, together with the derivation of the parent varieties:—

No.	Cross.	Derivation.
1	Ba.11569 x Q.813	Noble canes (<i>S. officinarum</i>)
2	Synthetic Kassoer) x B.2935)	<i>S. spontaneum</i> (Java) and <i>S. officinarum</i> .
3	B.3215 x B.H.10(12)	<i>S. officinarum</i> and <i>S. spontaneum</i> (Java)
4	Uba x B.6835)	<i>S. sinense</i> and <i>S. officinarum</i> .
5	Uba x B.603)	
6	B.3215 x <i>S. spontaneum</i>	<i>S. officinarum</i> and <i>S. spontaneum</i> (Java) and <i>S. spontaneum</i> (India)
7	P.O.J.2725 x B.3364	<i>S. officinarum</i> and <i>S. spontaneum</i> (Java) and <i>S. Barberi</i> .
8	M.D.47 x P.O.J.234	<i>S. officinarum</i> and <i>S. spontaneum</i> (Java) and <i>S. Barberi</i> .
9	P.O.J.2725 x B.3358	<i>S. officinarum</i> and <i>S. spontaneum</i> (Java) and <i>S. Barberi</i> .
10	Uba x P.O.J.2878	<i>S. sinense</i> and <i>S. officinarum</i> and <i>S. spontaneum</i> (Java)
11	M.D.47 x Co.281	<i>S. officinarum</i> and <i>S. spontaneum</i> (India) and <i>S. barberi</i> .

Seedling populations from the above crosses will be raised and tested in frog hopper areas in order to obtain data which will be used to guide the work of breeding, in Barbados, commercial varieties for these areas.

IV. SPECIAL INVESTIGATIONS IN SUGAR CANE.

These were carried out in Barbados. The investigations represent particular lines of research work in connection with the breeding and testing of seedlings at the Central Sugar Cane Breeding Station.

(i) Growth Measurements and Maturity Experiments.

Each year, those seedlings which reach the Select Seedling stage are planted in Maturity Experiments, located under two environments, representative of the low-rainfall and high-rainfall districts of Barbados. In these experiments, growth measurements are carried out on select seedlings and standard varieties at fortnightly intervals during the growing season. The experiments are reaped in three sections—early, medium, and late—during the crop season. From the yields and chemical analyses obtained at the crop, the effect of environment on growth and on the rate of vegetative and chemical maturity is studied. In particular, the reaction of each seedling to environment is ascertained, and its growth type thereby determined. This knowledge is used in allocating seedlings to particular environments for further trial in the British West Indies.

For the season ending with the crop of 1936, growth measurements were made on, and maturity data obtained for, the seedlings B.3013, B.3125, B.3127, B.3138, B.3216, B.3234, and B.3239.

During this year, growth measurements are being made on the seedlings B.3013, B.3216, B.3234, B.3259 and B.3267.

Data is obtained on the standard varieties B.H.10(12), B.726 and B.2935 as a basis for comparison.

(II Gumming Disease Investigations.

A comprehensive account of the gumming disease investigations carried out in Barbados from 1930 to 1935 has been given in a previous publication (9). Therein are to be found detailed descriptions of the problems being investigated, of the experimental methods employed, and an account of the results already obtained. During the year under review, gumming disease investigations were continued, and are considered here under three headings.

(a) *The Relationship between Leaf Symptoms and Systemic Infection.* From the results of an experiment carried out in 1933-34, it was seen that in no case did a variety exhibit any appreciable degree of systemic infection unless the development of leaf symptoms was considerable. Consequently it was considered that, for practical purposes, varieties showing little or no leaf symptoms might be regarded as resistant to the disease.

These conclusions were tested in a similar experiment, which was carried out during the season 1935-36. Twenty varieties were used, which were chosen on account of their having previously shown a wide range of leaf infection intensities. During the growing season, records of leaf symptom intensity were made, and at five distinct periods cane cuttings were taken, and maintained for twenty-four hours in a saturated atmosphere in special humidity chambers. The extent of systemic infection was determined by the numbers of gum globules exuding per cane cross section.

The results of this experiment were in close agreement with those of the previous one. It is therefore considered reasonable to conclude that, for Barbados conditions, absence or scarcity of leaf symptom development may be regarded as a true indication of gumming disease resistance.

It is now the practice in selection work to eliminate at an early stage in their trials all those seedlings which show more than a fixed standard of leaf symptom intensity (see following section).

(b) *Gumming Disease Resistance Tests.* Routine gumming disease resistance tests are carried out, under conditions of natural infection in the field, in the multiplication plots of first year seedlings at Dodds. From the data obtained in this way, it is possible to classify the seedlings according to their resistance to the disease, and to eliminate those showing more than moderate susceptibility before their second year trials.

During 1935, ninety-three noble cane seedlings were under observation, and eighteen were eliminated on account of susceptibility.

For the present season, leaf symptom intensities are being recorded for one hundred and fourteen noble cane seedlings.

(c) *The Inheritance of Gumming Disease Resistance.* This is a study in which seedling populations from particular parentages are considered in regard to their reaction to the disease. Notable differences in this respect between various sections, groups and classes of sugar cane varieties have already been found (9), and further data is added each year as new series of seedlings are tested.

In addition to the records for noble cane seedlings, referred to above, special plantings of seedlings containing a greater or less proportion of wild blood are made each year for gumming disease resistance testing. During 1935, seventy-seven such seedlings were observed, and in the present season ninety-nine are being tested. It is noted that the number of nobilised seedlings showing appreciable susceptibility to gumming disease is very small indeed.

(III) Root Development Investigations.

The second root development investigation was concluded during the year under review.

The varieties included in this investigation were B.H.10(12), Ba.11569, B.726, B.2935, P.O.J.2878, Co.213, Uba and *Saccharum spontaneum* (local Coimbatore form). Examinations of root development were made at Codrington Experiment Station at four times during the growing season 1935-36. A short account of the findings of the first and second examinations was given in the Report for 1934-35 (11).

The third examination was made in December, 1935—January, 1936, following a period in which conditions were favourable for growth since the second examination. All varieties except the Barbados noble canes had arrowed profusely. Varietal differences in the development of above-ground parts were rather marked at this time. Such varieties as Uba, Co.213 and *Saccharum spontaneum* had several tillers and young canes in addition to the old canes which made up the stools. Such tillers and young canes were few in the noble canes. Features of root development could be clearly related to above-ground characteristics.

In the main, the examination revealed similar trends in root distribution and development to those noted in the first investigation at this season (6). It was apparent, however, that the developmental cycle of the roots was further advanced than at that time, with higher percentages of moribund, non-absorbing roots present, particularly in the lower soil layers. This was to be related to the continued favourable growing conditions resulting in a very forward condition of the crop. The noble cane varieties had higher percentages of absorbing roots than the nobilised varieties and wild types, indicating a longer vegetative growth cycle in the roots comparable with that occurring in their canes. The wild cane, *Saccharum spontaneum*, represents the extreme short season type, characterised by rapid early development and early flowering. In the roots, the fibrous root bearing phase was noted to be very short, and by this

time the percentage of non-absorbing roots was greater than in any other variety.

The fourth examination was carried out in May, 1936, following a period in which rainfall had been exceptionally low, and severe drying out had occurred, particularly in the noble cane varieties. Root systems were characterised by the presence of large numbers of black wiry roots in all soil horizons. Many of these were decaying, having completed their development cycle, and were of no apparent value in absorption. Those roots which were living, were rapidly losing their fibrous secondaries, and becoming non-absorbing. Newly produced roots, from young canes and tillers, penetrated into the deeper soil in a manner reminiscent of the early-formed roots seen at the first examination one year before. Varietal differences in root distribution at this time appeared to be related chiefly to the production of such late roots, which in turn was clearly related to the production of late shoots by the stools. The wild canes and nobilised types, in which tillers and young canes were numerous, had more vigorous root systems than the noble cane varieties, where old canes constituted the major part of the stools.

Important indications of differences in the length of the growth cycle in the roots were found, even within the noble cane varieties. At this time, for example, B.H.10(12), which is characterised by a long vegetative cycle in the above-ground parts, was seen to exhibit an appreciably slower decrease in fibrous root intensity on the primary roots than the other Barbados varieties.

A detailed account of this investigation will shortly be available (13), where the conclusions from the root development studies already done in Barbados are presented, together with a discussion of the value of these investigations as an aid to sugar cane breeding.

(IV) Fuzz Storage Experiments.

In a previous fuzz storage experiment, described in the Report for 1934—35, it was found that after eight months' storage under the best conditions used then—viz. in an atmosphere of carbon dioxide over calcium chloride—the mean germination was only 25% of the immediate germination. In addition, it was noted that there was considerable variation in the germination of stored fuzz of individual crosses. A second experiment was devised to test the effect of further storage treatments on sugar cane fuzz, with the object of increasing ultimate germinations, and also to obtain more information on the storage properties of fuzz from various crosses.

The storage treatments employed were as follows:—

- (1) 5 grams calcium chloride per 1,000 ccs. space, in carbon dioxide.
- (2) 10 grams calcium chloride per 1,000 ccs. space, in carbon dioxide.
- (3) 20 grams calcium chloride per 1,000 ccs. space, in carbon dioxide.

The above treatments were maintained at room temperature, to study the effect of varying quantities of calcium chloride on germination after storage.

- (4) 10 grams calcium chloride per 1,000 ccs. space in carbon dioxide at room temperature, approximately 70°—80°F. (this corresponds to treatment (2) above).

- (5) 10 grams calcium chloride per 1,000 ccs. space in carbon dioxide at 42°F.
- (6) 10 grams calcium chloride per 1,000 ccs. space in carbon dioxide at 32°F.

These treatments were devised to study the effect of storage temperature on ultimate germination of fuzz.

Twelve crosses, from a wide range of parental material embracing the blood of several species of *Saccharum*, were used for the experiment. In order to find whether degree of retention of viability under storage is a genetic characteristic, eleven of those crosses used in the previous experiment were again included.

The fuzz was collected from the breeding plots at Lion Castle in November—December, 1935, stored in sealed tins, and sown in boxes on July 16th, 1936. Germination counts were made on August 10th, 1936.

The results of the experiment are presented, for convenience, in the form of a summary:—

- (1) Appreciably higher ultimate germinations were obtained from fuzz maintained in cold storage. 32°F. proved to be a somewhat better storage temperature than 42°F., and considerably better than room temperature.
- (2) Individual crosses again showed considerable variation in germination after storage. In making comparisons between the two experiments, for the crosses used in both, it was seen by tabulating the crosses in order of germination that there was remarkable consistency between the two experiments, both in the immediate germination figures and in the germinations after storage by the best treatment in each experiment.
- (3) It was noted that loss of viability in storage, considered as a percentage of immediate germinating capacity, was greater in the fuzz of noble cane crosses than in that of crosses involving the blood of wild *Saccharum* species. This is of interest in view of the fact that the fuzz of noble cane varieties has generally a considerably higher immediate germination than that of nobilised types. This has been observed for a number of years, and was very noticeable in the particular crosses used in the storage experiments.

Fuzz storage experiments were started with the object of finding whether sufficiently high germinations could be expected after an eight months' storage period to allow of a routine July planting of fuzz harvested the previous November—December. At the same time an alternative scheme—the field nursery stage—was used.

The field nursery scheme has proved of considerable value in seedling trials, as shown in a previous section of this Report, and will in future represent a routine stage in seedling selection for this reason. Consequently, no further experiments on fuzz storage will be carried out for the present.

V. LIST OF PUBLICATIONS ISSUED.

- (1) "Report for the Period ending September 30th, 1934".
- (2) "Report on the Sugar Cane Breeding Problems of Antigua, Trinidad and St. Kitts"—A. E. S. McIntosh, Bull. No. 1, Sept., 1933.
- (3) "Report on the Sugar Cane Variety Problems in St. Lucia"—A. E. S. McIntosh, Bull. No. 2, June, 1934.
- (4) "Report on a Visit to Jamaica"—A. E. S. McIntosh, Bull. No. 3, Sept., 1934.
- (5) "Report on a Visit to Grenada"—A. E. S. McIntosh, Bull. No. 4, Nov., 1934.
- (6) "Investigations into the Root Development of the Sugar Cane in Barbados. (1) Root Development in Several Varieties under one Environment"—G. C. Stevenson and A. E. S. McIntosh, Bull. No. 5, Feb., 1935.
- (7) "An Account of the Policy and Methods Employed in the Breeding and Initial Stage of Selecting Sugar Cane Seedlings"—A. E. S. McIntosh, Bull. No. 6, June, 1935.
- (8) "Report on a Second Visit to Antigua"—A. E. S. McIntosh, Bull. No. 7, July, 1935.
- (9) "Gumming Disease Investigations in Barbados"—A. E. S. McIntosh and G. C. Stevenson, Bull. No. 8, August, 1935.
- (10) "An Account of the Methods Employed in Testing and Selecting Sugar Cane Seedlings for Thick-Cane Areas in the British West Indies"—A. E. S. McIntosh.
 "An Account of the Methods Employed in Carrying out Sugar Cane Seedling and Variety Trials in Barbados"—A. E. S. McIntosh and C. B. Foster, Bull. No. 9, Sept., 1935.
- (11) "Report for the year ending September 30th, 1935".
- (12) "The Yield of Sugar Cane in Barbados in 1936"—Bull. No. 10, August, 1936.
- (13) "Investigations into the Root Development of the Sugar Cane in Barbados. (2) Further Observations on Root Development in Several Varieties under one Environment".—G. C. Stevenson, Bull. No. 11. To be issued shortly.

**BRITISH WEST INDIES CENTRAL SUGAR CANE BREEDING
STATION.**

STATEMENT OF EXPENDITURE FOR 1935—36.

Recurrent:—

				£	s.	d.
Personal Emoluments	..	..	..	1,051	15	3
Provident Fund	..	..	..	22	10	0
Seedling Trials	..	..	..	393	16	5
Stationery and Publications	..	..	..	61	5	5
Travelling	..	..	..	207	4	3
Contingencies	..	..	..	8	7	6
				1,744	18	10

Capital	..	..	..	52	16	2
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Totals:—

Recurrent	..	..	..	1,744	18	10
Capital	..	..	..	52	16	2
				1,797	15	0

BRITISH WEST INDIES C

CHART TO ILLUSTRATE THE GENERAL SCHEME
FOR THE BR

THE AREAS.	BREEDING. MATERIAL.	SCHEME OF BREEDING. Oct.—Dec.	FIELD NURSERY April—Oct
A. Thick-Cane Areas. (i.e. where growing conditions are at least reasonably good). (a) Where mosaic disease is not of major importance—Barbados, St. Kitts, St. Lucia, greater parts of Jamaica, Antigua and Trinidad.	Thick-caness belonging to the species <i>Saccharum officinarum</i> .	Hybridisation between thick-cane varieties (chiefly Barbados varieties). Approximately six proven crosses at present made, and in addition approximately ten experimental crosses whose progenies are tested in order to note if any is sufficiently good to be added to the above.	Approximate 10,000 seeds planted.
(b) Where mosaic disease control is impracticable in thick-cane areas, e.g. considerable percentage of Jamaica sugar cane lands.	Java varieties of varying degrees of <i>glagah</i> (<i>Saccharum spontaneum</i>) nobilisation and varieties of species <i>Saccharum officinarum</i> (chiefly Barbados varieties).	Nobilisation of Java 'glagah' — <i>Saccharum spontaneum</i> , chiefly with Barbados noble varieties.	Approximate 2,500 seeds planted.
B. Areas with poor growing conditions—parts of Trinidad, Antigua, Jamaica.	Indian varieties of <i>Saccharum spontaneum</i> , Uba— <i>Saccharum sinense</i> , and North Indian varieties, <i>Saccharum barberi</i> and their early nobilisations.	Nobilisation of these by crossing chiefly with Barbados varieties of <i>Saccharum officinarum</i> and crossing derivatives between themselves.	Approximate 2,500 seeds planted.
C. Froghopper Areas.	Consignments of fuzz from a large variety of crosses sent to Trinidad for froghopper resistance tests on resultant seedling populations.		

PENDIX "A."

ENTRAL CANE BREEDING STATION.

ES OF BREEDING AND TESTING SEEDLINGS IN BARBADOS,
ITISH WEST INDIES.

TESTING AND SELECTING SEEDLINGS.

	FIRST YEAR SEED- LING TEST Oct. — Year — March	MULTIPLICATION, GUMMING DISEASE RESISTANCE AND MINOR SELECTION PLOTS.	SECOND YEAR TRIALS.	SELECT SEEDLING TRIALS.	VARIETY TRIALS.
ly lings	Approximately 6,500 planted.	Approximately 100 select- ed and planted in above tests about March. These tests last approxi- mately 20 months.	Approximately 60 tested. These selections sent to Plant Quar- antine Station at conclusion of second year tests. While being quarantined, they are further tested in Barbados when fuller information is obtained for each, before real release for trial outside Barbados.	Approximately 6 tested.	Approximately 1 to 3 tested.
ly lings	Approximately 2,000 planted.	Approximately 50 plant- ed. (March—Nov. of same year).	Approxi- mately 30 tested.	Selections from these tests sent to Plant Quarantine Station and not further tested in Barbados.	
ly lings	Approximately 1,500 planted.	Approximately 35 plant- ed. (March—Nov. of same year).	Approxi- mately 20 tested.		

